

layer, film or sheet formed from this dispersion has a conductivity of  $> 100 \text{ S/cm}$  after removal of the dispersant.

A subject of the invention is furthermore a process for the preparation of the above-named dispersion, in which in this order

- (a) an intrinsically conductive polymer is prepared from monomers, wherein the temperature during the polymerization is controlled such that it does not exceed a value of more than  $5^{\circ}\text{C}$  above the starting temperature,
- (b) the product from stage (a) is trituated and/or dispersed in the presence of a non-electrically conductive, non-polymeric polar substance which is inert vis-à-vis the conductive polymer, applying adequate shearing forces, wherein the weight ratio between the conductive polymer and the polar substance is 2:1 to 1:10,
- (c) the product from stage (b) is dispersed in a dispersant which is liquid at room temperature, wherein the weight ratio between the conductive polymer and the dispersant is less than 1 : 10.

A subject of the invention is also the use of a dispersion as named above or as obtained according to the process named above, to prepare mouldings, self-supporting films or coatings with electric conductivity.

Further preferred embodiments of the present invention follow from the dependent claims.

The success achieved according to the invention is to be regarded as surprising in particular because in general a dispersion process is regarded as harmful to the conductivity of the polymer.

b) inert solvents: water, DMF, DMSO,  $\gamma$ -butyrolactone, NMP and other pyrrolidone derivatives, dioxan, THF;

wherein this list is by way of example.

The dispersal or trituration with the polar substance can be carried out in general in dispersion devices such as high-speed mixers (e.g. so-called fluid mixers) or under ultrasound, in a ball mill, bead mill, a two-roll or three-roll mill or a high-pressure dispersion device (Microfluidics type).

In high-speed mixers or under ultrasound, the processing time is at least 3 minutes. In ball mills, on two- or three-roll mills or in other units with a high shearing force, a longer treatment time, e.g. of at least 30 minutes, is required. The simultaneous application of an electric field, in particular an electric alternating field with frequencies between 10 kHz and 10 GHz, can be advantageous; in this case, more than 24 hours are normally required.

The polar, non-conductive substance that is inert vis-à-vis the intrinsically conductive polymer is added in a quantity that results in a weight ratio of 2:1 to 1:10 between the conductive polymer powder and the polar substance.

Furthermore, at least one non-conductive polymer, in particular a thermoplastic polymer, is preferably present when carrying out stage (b). For example, polyethylene terephthalate copolymer, commercially available from Eastman Kodak or from Degussa, or a polymethyl methacrylate (PMMA) from Degussa, can be used. The presence of the thermoplastic polymer requires the dispersion to be carried out with high shear and at temperatures above 50°C, e.g. at temperatures between 50 and 200°C or between 70 and 120°C, for example at say 90°C.

- for the manufacture of semiconductor elements such as diodes, transistors, among others,
- as photoconductors or in photovoltaic energy conversion,
- in compositions with metals or semimetals or in compositions with different conductive polymers exploiting the thermoelectric effect as temperature sensors (IR absorption) or in thermovoltaic energy conversion,
- as sensors,
- as indicators, e.g. by electrochromism, microwave absorption, thermoelectrical force etc.,
- in electrolysis or electrosynthesis processes as electrocatalytic electrodes (e.g. in fuel cells),
- in photoelectrocatalysis or synthesis and in the case of photovoltaic effects,
- in corrosion protection, e.g. in the case of anodic corrosion protection,
- as electrodes in accumulators,
- as UV- and light-stable pigments,
- as electrodes or leads in electroluminescence systems (e.g. as non-transparent so-called "back electrodes" or as transparent so-called "front electrodes"),
- as a hole injection layer or anodic buffer layer or as transparent anodes in organic/polymeric light diodes or solar cells.

The invention is to be explained in further detail with reference to the embodiment examples listed below.

- (b) the product from stage (a) is triturated and/or dispersed in the presence of a non-electrically conductive, non-polymeric polar substance which is inert vis-à-vis the conductive polymer, applying adequate shearing forces, wherein the weight ratio between the conductive polymer and the polar substance is 2:1 to 1:10,
- (c) the product from stage (b) is dispersed in a dispersant which is liquid at room temperature, wherein the weight ratio between the conductive polymer and the dispersant is less than 1 : 10.
7. Process according to claim 6, **characterized in that** at no time during the polymerization is the rate of the temperature rise during stage (a) more than 1 K/minute.
8. Process according to claim 7, **characterized in that** in stage (b) furthermore at least one non-conductive polymer is present.
9. Process according to claim 8, **characterized in that** the non-conductive polymer is a thermoplastic polymer.
10. Process according to one of claims 6 to 9, **characterized in that** the product from stage (b) is subjected to a post-treatment.
11. Process according to claim 10, **characterized in that** the portion of the polar substance or of the non-conductive polymer in the product from stage (b) is reduced during the post-treatment by washing or extraction.
12. Process according to one of claims 6 to 11, **characterized in that** solvents and/or auxiliaries are added